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**Device for sharpening chain saw teeth**

- 10 The present invention refers to a device for sharpening chain saw teeth, in particular a chain saw which is portable and applicable in the field, and where the chain is not to be taken off the chain saw blade when being sharpened.

Several known solutions exist for sharpening chain saw teeth, all of them being limited  
15 either to the use in the service and maintenance facilities, or to different embodiments of hand files. So for instance a solution is disclosed in the US 3,172,306 enabling guidance of the file in the set direction providing an accurate geometry of cutting surfaces of each tooth. The drawback of the said solution is the slowness of the sharpening and the inability of ensuring the repeatability of sharpening even with the very next tooth. The device is  
20 unstable when used and unsuitable for use in an arbitrary location. Another solution is known from the US patent No. 4,762,027 where a grinding wheel travels during sharpening over an arch determined by a bearing located transversally to the chain plane. Such an arrangement results in the convexity of the cutting edge of a tooth representing a situation which is the opposite to what is wanted. Still another solution disclosed in the US  
25 4,319,502 comprises a grinding wheel swinging in a vertical plane, however, this solution did not remedy the problem of the convexity of the surface to be sharpened. In addition, the said device is too big and too heavy for field work, and is also unfavourable with regard to the power consumption.

- 30 It is the object of the present invention to create a device for sharpening chain saw teeth which is simple to use, easily portable, and which ensures, regardless of the location of use, high quality and repeatable precision of the sharpening.

According to the invention the object set forth is solved by that a sharpening device enables swinging of a grinding wheel transversally to a single tooth of a chain and at an adjustable angle of attack, ensuring therewith levelled cutting surfaces and an appropriate cutting angle of each tooth. The grinding wheel of a relatively small diameter is powered  
5 by an actuator having a relatively low power and high rotational speed, resulting in a high cutting speed. Said actuator can be either an electric motor, supplied with electricity from an electric mains or a battery, a pneumatic motor or a hydraulic motor.

The device according to the invention comprises a spatial curved carrier fixed by means of  
10 a fastening means to the upper end of an arm originating in a body, so that said carrier can be optionally shifted on the circular arc along said fastening means. Said body is provided on the lower side and over the entire length thereof with a groove which penetrates the body in the area between said arms and is connected to a gap between said arms. The free end of the carrier is connected by means of a mounting to a swivel arm which lies  
15 essentially in a plane being predominantly parallel to the plane of the carrier. The actuator with the grinding wheel is associated to the free end of the swivel arm.

The first, left body half is formed with a click bulge on the outside i.e. on the side facing away from a chain blade, said click bulge intended for cooperation with a click spring  
20 guard. An adapter is associated to the inside of the left body half, said adapter reaching the chain area with an inwardly bent flange provided at the free end thereof. A flexible adapter is associated to the inside of the right body half, said adapter reaching the chain area with an inwardly bent flange provided at the free end thereof. Said flanges of each adapter impose from the above upon a pair of pins of each chain link. Furthermore, the left half  
25 comprises a distance bolt with which the adapter is moved in either direction. Two distance screws extend through the right body half and through the flexible adapter, said distance screws being intended for fixing the device to the saw blade. The right body half is formed with a recess in the upper part thereof and in the area between the arms of the body, a correspondingly formed pressure member, which can be swung about an adjusting screw,  
30 rests in said recess. Said pressure member is intended to compensate potential clearance of the adjusting screw. An adjusting nut mates with said adjusting screw determining the sharpening depth in the horizontal direction i.e. in the direction of the chain of the saw.

The pressure member comprises a pair of distance bolts arranged practically perpendicularly to the saw blade, when the sharpening device is in the state of standby, and at that time they are pressing against the flexible adapter with the ends thereof. A click spring guard is located on the pressure member comprising a pair of shoulders arranged in  
5 a way that one of them holds a tooth to be sharpened when the click spring guard cooperates with the click bulge.

In order to facilitate as accurate sharpening of the teeth as possible the mounting of the spatial curved carrier and the swivel arm must be formed without any superfluous friction  
10 and clearance. This is achieved by a pair of bearings being held on a constant mutual distance by means of a spacer which is indirectly in contact with the inner ring of each bearing, whereas the outer ring of each bearing is held on one side with the head of a bolt carrying said bearings and on the other side with a nut.

15 An additional measurement for increasing the accuracy of sharpening the teeth of the chain saw provides for to eliminate the axial clearance of the rotor shaft of the actuator. This is achieved by that the first rotor bearing located on the side of the grinding wheel is fixed by the outer ring of said bearing in the stator of the actuator, whereas the inner ring of said bearing is held on one side with a sleeve extending up to the rotor of the actuator and on  
20 the other side with a shoulder for receiving the grinding wheel.

The present invention will become more fully understood from the detailed description given hereinafter and the accompanying drawings, wherein

- 25 Fig. 1 shows a perspective view of a device according to the invention,  
Fig. 2 shows a side view of the device of Fig. 1 with a grinding wheel moved further away,  
Fig. 3. shows a side view of the device of Fig. 2 with a grinding wheel moved closer,  
Fig. 4 shows another side view of the device of Fig. 2 with a grinding wheel moved  
30 closer,  
Fig. 5 shows the device according to the invention in a partial cross-section,  
Fig. 6 shows the device of Fig. 5 with a fixed chain saw, and

Fig. 7 shows an actuator in a partial longitudinal section.

A device according to the invention comprises a body 1 from the first side thereof, in a given case from the upper side, originate two arms 2, 3 formed on each longitudinal end of said body, a gap 4 being arranged between said arms. The body 1 is formed with a groove 5 from the second side thereof, in a given case from the bottom side, so that the body 1 in a cross direction resembles a shape of the upside down character U. Said groove 5 penetrates the body 1 in the area between both arms 2, 3 so that said groove is connected to the gap 4 and is intended to receive a saw blade 6 to which a chain 7 is drawn up, said chain consists of chain links comprising teeth 8 and guide members 9 being integral with said teeth, each said link being associated with the chain 7 via a pair of pins 10.

A spatially curved carrier 12 is fixed to the free end i.e. to the upper end of the aforementioned arms by means of a fastening means 11 so that it can be optionally shifted along an arc and the fastening means 11 when the latter is loosened. The tilting of the carrier 12 relative to the imaginary plane of the saw teeth 8 in the area of the sharpening preferably equals to approximately  $45^\circ$ . The free end of the carrier 12 which is located at the starting position of the device operation approximately in the mid area above the chain 7, is connected to a swivel arm 14 by means of a mounting 13, said arm being essentially arranged in a plane being predominantly parallel to the plane of the carrier 12. An actuator 15 with a grinding wheel 16 is attached to the free end of the swivel arm 14. Said actuator 15 can be either an electric motor, supplied with electricity from electric mains or a battery, and a pneumatic motor or a hydraulic motor. In order to achieve sharpening accuracy, the mounting 13 of the spatially curved carrier 12 and the swivel arm 14 must be formed with the smallest clearance possible. Therefore, the mounting 13 of the swivel arm 14 in the spatially curved carrier 12 consists of two bearings being held in a constant mutual distance by means of a spacer which is in direct contact with the inner ring of each bearing. On one side, the outer ring of each bearing is held by the head of a bolt carrying both bearings, and on the other side it is held by a nut. The said spacer holds the bearings in such a distance that the swinging movement of the swivel arm 14 is always secured without unnecessary wear and clearance. An adjusting arm 17 with an on-off switch 17 is located on said actuator 15, and said switch is preferably of such a form that the actuator

15 is turned off when the switch 18 is released. Using a set means 19, the mounting 13 and the swivel arm 14 can be moved in a guide 20 nearer and further, respectively, in the direction towards and away from the axis of the grinding wheel 16, respectively and the grinding pitch in a vertical direction is set therewith. The chosen position of the swivel arm  
5 14 relative to the spatially curved carrier 12 can be positionally secured by means of a fastening means 21.

The sharpening accuracy is additionally increased by means of mounting of the rotor shaft of the actuator 15 in a way that the axial clearance of said shaft is practically entirely  
10 eliminated. This is achieved by that the first rotor bearing 22, facing the grinding wheel 16, is fixed by the outer ring thereof in a stator of the actuator 15, whereas the inner ring thereof is held on one side with a sleeve 23 extending to the rotor of the actuator 15 and on the other side, by a shoulder 24 which receives the grinding wheel. Said first bearing 22 is preferably selected as a roller bearing.

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The device according to the invention is further described with reference to the Fig. 5 and 6 showing cross sectional views of a part of said device. As already mentioned above, the said body 1 resembles, in the transverse direction the shape of the letter U turned upside down, comprising the first, left half 25, the second, right half 26 and the groove 5  
20 extending therebetween to receive the saw blade 6 with the chain 7. The first, left half 25 of the body 1 is provided on its outer side, i.e. the side facing away from the saw blade 6, with a click bulge 27 intended for cooperation with a click spring guard 28. An adapter 29 is attached to the inner side of the left half 25 of the body 1 extending with a flange 30 into the area of the chain 7, said flange 30 being formed on the free end of said adapter and  
25 turned inwards. Similarly, a flexible adapter 31 is attached to the inner side of the right half 26 of the body 1 extending with a flange 32 into the area of the chain 7, said flange 32 being formed on the free end of said adapter and turned inwards. Said flanges 30, 32 of the respective adapter 29, 31 sit from the above onto the pair of pins 10 of the respective link of the chain 7 when the device according to the invention is set correctly. The factory  
30 setting of the device according to the invention with regard to the thickness of the saw blade 6 is achieved by means of a distance bolt 33 with which the adapter 29 is moved closer to or away from. Through the right half 26 of the body 1 and through the flexible

adapter 31 extend two distance bolts 34 which are tightened up when the device according to the invention is mounted onto the saw blade 6 so as to press against said saw blade with their respective ends, whereby the sharpening device is stabilized on said saw blade. Said distance bolts 34 are connected in a limited way to the right half 26 of the body 1 by means  
5 of a nut and a lock nut so that they can always be tightened up with the optional force, yet the pressure against the saw blade 6 remains the same in every instance.

The right half 26 of the body 1 is formed with a recess 35 in the upper part thereof and in the area between the arms 2, 3 of the body 1, a suitably formed pressure member 37  
10 cooperates with the said recess when the sharpening device is mounted onto the saw blade 6, said pressure member 37 being pivoted about an adjusting screw 36, whereby in the closed position the pressure member 37 compensates any potential clearance of the adjusting screw 36. The grinding depth in a horizontal direction can be set by moving the pressure member 37 by means of an adjusting nut 36' arranged on the adjusting screw 36.  
15 In order for the pressure member 37 to be fine set to the thickness of the saw blade 6 it comprises a pair of distance bolts 38 arranged practically perpendicularly to the saw blade 6, and when the sharpening device is ready to operate, said bolts press with the ends thereof against the flexible adapter 31 which is seated with the flange 32 thereof from the above onto two pins 10 of the chain 7. The aforementioned click spring guard 28 is  
20 attached to the said pressure member 37 said guard comprising a pair of shoulders 39, 40 arranged in a manner that one of them arrests the tooth 8 being sharpened when the guard 28 is closed i.e. when said guard cooperates with the click bulge 27. The first of said shoulders 39, 40 is intended for arresting the right tooth and the second one for arresting the left tooth of the chain 7. Said adjusting screw 36 is intended for setting the sharpening  
25 depth.

The sharpening device according to the invention is mounted onto the saw blade 6 and fixed by tightening the distance bolts 34. The flange 30 of the adapter 29 of the left half 25 of the body 1 must sit from above onto two pins 10 of the chain 7. Afterwards, the pressure  
30 member 37 is swung in order to sit into the recess 35 and now also the flange 32 of the flexible adapter 31 of the right half 26 of the body 1 is seated from the above onto two pins 10 of the chain. The chain 7 is manually pulled into the sharpening area so that the tooth 8

to be sharpened is centred between the flanges 30, 32 and below the grinding wheel 16. Now, the click spring guard 28 is swung over the chain 7 so that it meshes with the click bulge 27, where one of the shoulders 39, 40 arrests the tooth 8 to be sharpened. The actuator 15 is switched on and swung about the mounting 13 so that the respective tooth 8  
5 is sharpened. When the first saw tooth 8 is sharpened the guard 28 is removed so that it cooperates no longer with the bulge 27, and the pressure member 37 is partially swung out releasing the chain 7 which is again manually forwarded by the distance of one tooth 8 arranged on the same side. The pressure member 37 is swung back towards the blade 6 and the guard 28 is locked again onto the bulge 27, and the sharpening of the tooth 8 is  
10 repeated.

Due to the form of the saw teeth 8 the height thereof decreases with the number of sharpenings resulting in a smaller cutting depth. In order to maintain the proper cutting depth, the guide member 9 located in front of each tooth 8 must be occasionally lowered.  
15 The fastest way to achieve this is to insert a wider grinding wheel with the slanted grinding face enabling grinding down to the new height in the smallest number of steps possible.

### Claims

1. Device for sharpening chain saw teeth, in particular a chain saw which is portable and applicable in field, and where the chain is not to be taken off the chain saw blade when sharpened, *characterized in that* a spatial curved carrier (12) is fixed, by means of a fastening means (11), to the upper end of one of arms (2, 3) originating in a body (1), so that said carrier (12) can be optionally shifted on the circular arch along said fastening means (11), said body is provided on the lower side and over the entire length thereof with a groove (5) which penetrates the body (1) in the area between said arms (2, 3) and is connected to a gap (4), the free end of the carrier (12) is connected by means of a mounting (13) to a swivel arm (14) which lies essentially in a plane being predominantly parallel to the plane of the carrier (12), an actuator (15) with a grinding wheel (16) is associated to the free end of the swivel arm (14), that the first, left half (25) of the body (1) is formed with a click bulge (27) on the outside i.e. on the side facing away from a chain blade (6), said click bulge intended for cooperation with a click spring guard (28), an adapter (29) is associated to the inside of the left half (25) of the body (1), said adapter reaching the chain (7) area with an inwardly bent flange (30) provided at the free end thereof, that a flexible adapter (31) is associated to the inside of the right half (26) of the body (1), said adapter reaching the chain (7) area with an inwardly bent flange (32) provided at the free end thereof, that the left half (25) comprises a distance bolt (33) with which the adapter (29) is moved closer to or away from, and that two distance screws (34) extend through the right half (26) and through the flexible adapter (31), that the right half (26) of the body (1) is formed with a recess (35) in the upper part thereof and in the area between the arms (2, 3) of the body (1), a correspondingly formed pressure member (37) which can be swung about an adjusting screw (36) rests in said recess, an adjusting nut (36') mates with said adjusting screw (36) by means of which is determined the sharpening depth in the horizontal direction, that the pressure member (37) comprises a pair of distance bolts (38) arranged practically rectangular to the saw blade (6), when the sharpening device is ready to operate, and at that time they are pressing against the flexible adapter (31) with the ends thereof, and that a click spring guard (28) is located on the pressure member (37) comprising a pair of shoulders (39, 40) arranged in a way that one of them holds a tooth (8) to be



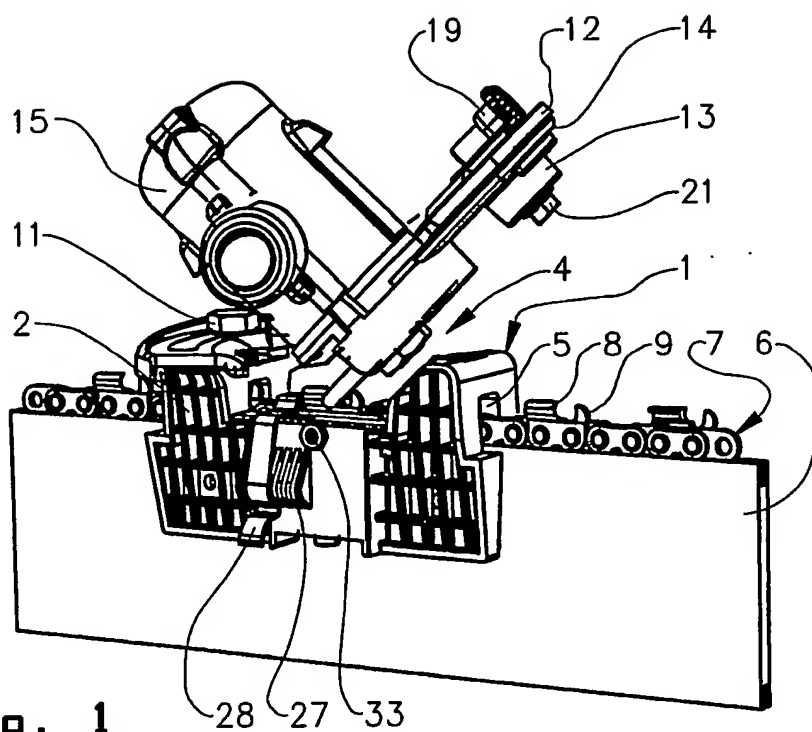
sharpened when the click spring guard (28) cooperates with the click bulge (27).

2. Device according to claim 1, *characterised in that* the flanges (30, 32) of the respective adapter (29, 31) impose from the above upon a pair of pins (10) of each chain (7) link.  
5
3. Device according to claims 1 and 2, *characterised in that* an adjusting nut (36') arranged on said adjusting screw (36) is provided for setting the sharpening depth.
- 10 4. Device according to any of claims 1 to 3, *characterised in that* distance bolts (34) are tightened up when mounting the device onto the saw blade (1) so that they press against said saw blade with the ends thereof and stabilize the sharpening device on said saw blade.
- 15 5. Device according to any of claims 1 to 4, *characterised in that* the mounting (13) of the spatially curved carrier (12) and the swivel arm (14) is formed by a pair of bearings being held on a constant mutual distance by means of a spacer which is indirectly in contact with the inner ring of each bearing whereas the outer ring of each bearing is held on one side with the head of a bolt carrying said bearings and on  
20 the other side with a nut, said spacer holds said bearings in such a distance that the swinging movement of the swivel arm (14) is ensured in every instance without any superfluous friction and clearance.
- 25 6. Device according to any of claims 1 to 5, *characterised in that* the mounting of a rotor shaft of the actuator (15) is formed in a manner that the first rotor bearing (22) facing the grinding wheel (16) is fixed with its outer ring in a stator of the actuator (15) whereas its inner ring is held, on one hand, with a sleeve (23) extending to the rotor of the actuator (15), and with a shoulder (24) for receiving the grinding wheel (16), on the other hand, the axial clearance of the said shaft is virtually entirely  
30 neutralised therewith.
7. Device according to any of claims 1 to 6, *characterised in that* said first bearing (22)

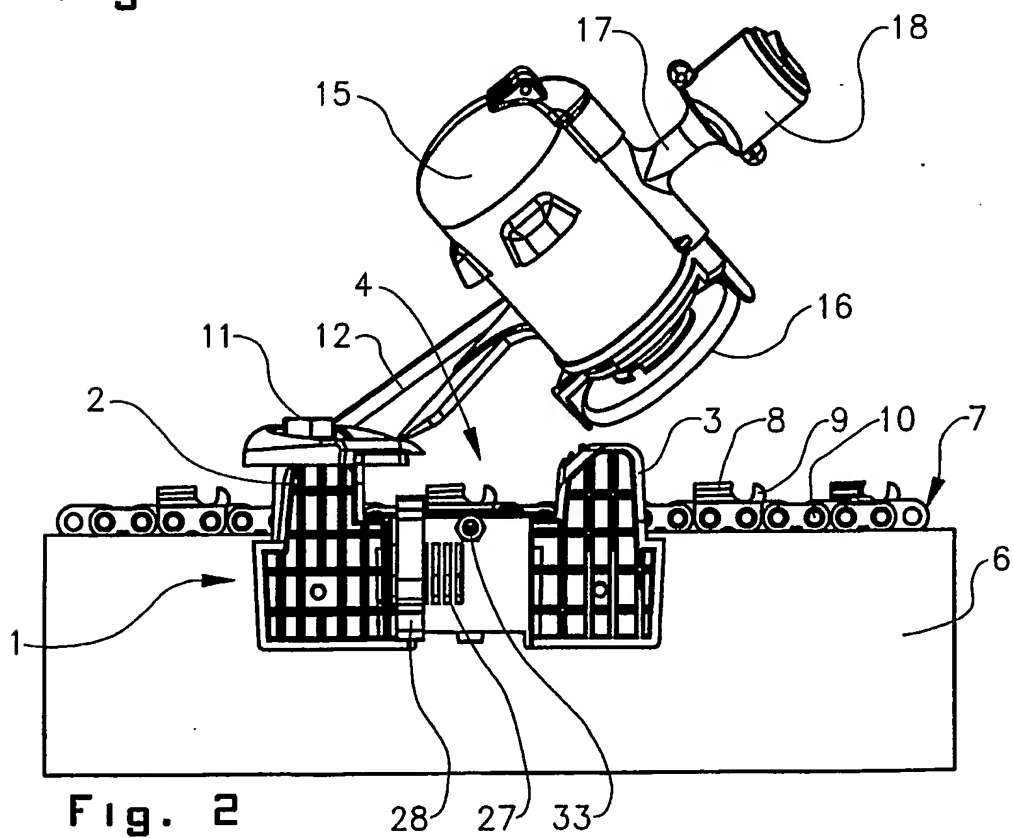
is preferably a roller bearing.

8. Device according to any of claims 1 to 7, *characterised in that* the slant of the spatially curved carrier (12) with regard to the imaginary plane of the saw teeth (8) in the area of the sharpening comprises about 45°.
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9. Device according to any of the preceeding claims, *characterised in that* the actuator (15) is either an electric, a pneumatic or a hydraulic motor.

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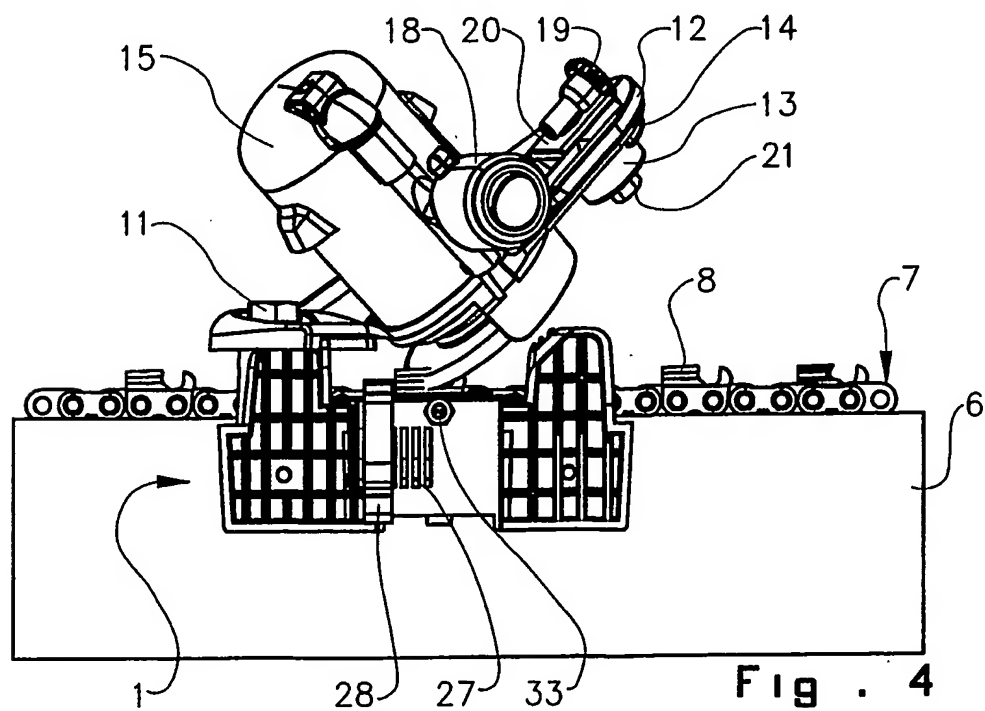
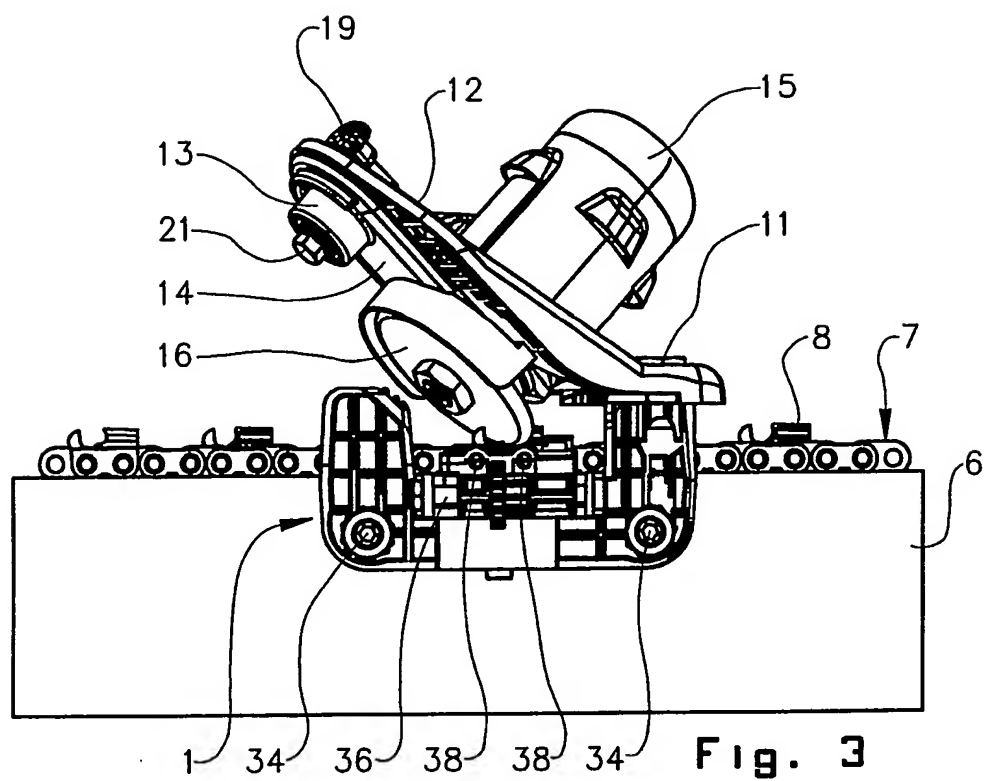


**Fig. 1**



**Fig. 2**

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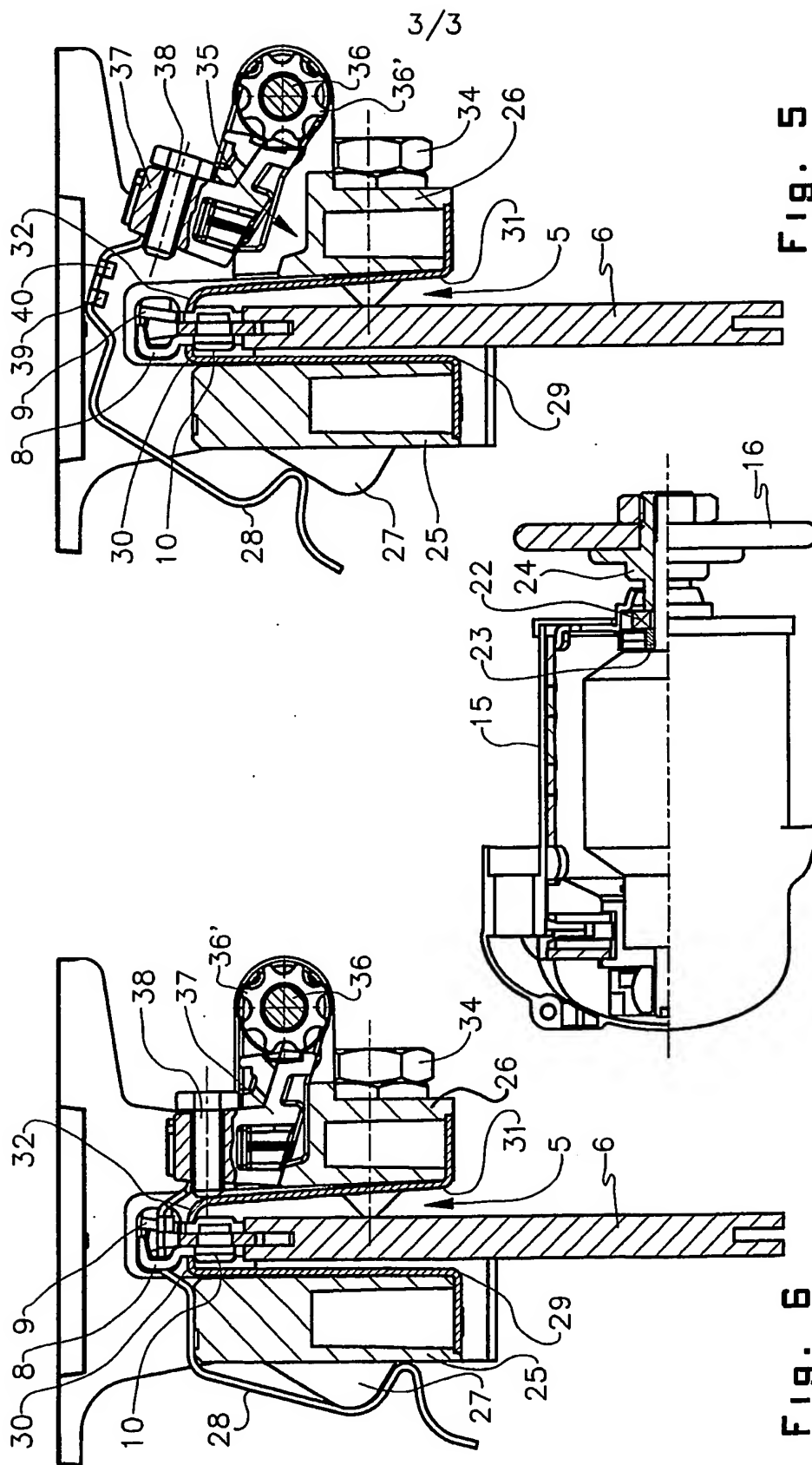


Fig. 5

Fig. 7

Fig. 6

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/SI2004/000039

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B23D63/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B23D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 762 027 A (FAGIOLINI ET AL) 9 August 1988 (1988-08-09) cited in the application column 2, line 3 - column 3, line 22; figures 1-7	1
A	DE 32 46 079 A1 (UMBACH, ALBERT) 14 June 1984 (1984-06-14) page 8 - page 11; figures 1,2	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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